

CLAIMS

What is claimed is:

- 1 1. A method comprising
2 providing a wafer comprising a plurality of copper structures partially
3 encased in a hydrophobic interlayer dielectric layer, where top surfaces of the
4 copper structures are exposed and substantially co-planar with a top surface of
5 the hydrophobic interlayer dielectric layer; and
6 selectively depositing a cobalt capping layer on the top surfaces of the
7 plurality of copper structures with substantially no deposition of the cobalt on the
8 top surface of the interlayer dielectric layer, using an aqueous electro-less bath
9 and applying sonic energy to the aqueous electro-less bath.
- 1 2. The method of claim 1, wherein the applying of sonic energy comprises
2 applying a selected one of mega and ultra sonic energy.
- 1 3. The method of claim 1, wherein the applying of sonic energy comprises
2 applying the sonic energy at a frequency range of 10 to 1200 kilohertz.
- 1 4. The method of claim 1, wherein the applying of sonic energy comprises
2 applying the sonic energy at a power level in a range of 1 to 5 watts/cm².
- 1 5. The method of claim 1, wherein the method further comprises
2 simultaneously rinsing and applying sonic energy to the hydrophobic interlayer
3 dielectric layer after said selective deposition of cobalt.
- 1 6. A method comprising

2 providing a wafer comprising a plurality of copper structures partially
3 encased in a hydrophobic interlayer dielectric layer, where top surfaces of the
4 copper structures are exposed and substantially co-planar with a top surface of
5 the hydrophobic interlayer dielectric layer;
6 selectively depositing a cobalt capping layer on the top surfaces of the
7 plurality of copper structures; and
8 simultaneously rinsing and applying sonic energy to the hydrophobic
9 interlayer dielectric layer to decrease the amount of cobalt particles adhered to
10 the hydrophobic interlayer dielectric layer.

1 7. The method of claim 6, wherein the applying of sonic energy comprises
2 applying a selected one of mega and ultra sonic energy.

1 8. The method of claim 6, wherein the applying of sonic energy comprises
2 applying the sonic energy at a frequency range of 10 to 1200 kilohertz.

1 9. The method of claim 6, wherein the applying of sonic energy comprises
2 applying the sonic energy at a power level in a range of 1 to 5 watts/cm².

1 10. An apparatus comprising:
2 a chamber adapted for cobalt deposition, including a holder to hold a
3 substrate with a hydrophobic interlayer dielectric layer; and
4 a sonic energy generator coupled to the chamber and adapted to allow
5 sonic energy be applied during deposition of cobalt to cap a number of
6 copper structures disposed on the hydrophobic interlayer dielectric
7 layer.

1 11. The apparatus of claim 10, wherein the apparatus further comprises at
2 least one tank coupled to the chamber and adapted to store and to provide the
3 interlayer dielectric layer with an aqueous electro-less bath; and the sonic energy
4 generator is also adapted to allow sonic energy be applied during the provision of
5 the aqueous electro-less bath.

1 12. The apparatus of claim 10, wherein the sonic energy generator is adapted
2 to apply a selected one of mega and ultra sonic energy.

3 13. The apparatus of claim 10, wherein the sonic energy generator is adapted
4 to apply the sonic energy at a frequency range of 10 to 1200 kilohertz.

1 14. The apparatus of claim 10, wherein the sonic energy generator is adapted
2 to apply the sonic energy at a power level in a range of 1 to 5 watts/cm².

1 15. An apparatus comprising:
2 a chamber including a holder to hold a substrate with a hydrophobic
3 interlayer dielectric layer;
4 at least one tank coupled to the chamber and adapted to store and to
5 provide the interlayer dielectric layer with an aqueous electro-less bath;
6 and
7 a sonic energy generator coupled to the chamber and adapted to allow
8 sonic energy be applied during the provision of the aqueous electro-
9 less bath.

1 16. The apparatus of claim 15, wherein the sonic energy generator is adapted
2 to apply a selected one of mega and ultra sonic energy.

3 17. The apparatus of claim 15, wherein the sonic energy generator is adapted
4 to apply the sonic energy at a frequency range of 10 to 1200 kilohertz.

1 18. The apparatus of claim 15, wherein the sonic energy generator is adapted
2 to apply the sonic energy at a power level in a range of 1 to 5 watts/cm².

1 19. An apparatus comprising:
2 a hydrophobic interlayer dielectric layer substantially free of adhered
3 cobalt particles;
4 a copper structure disposed on the interlayer dielectric layer; and
5 a cobalt capping layer disposed on a top surface of the copper structure.

1 20. The apparatus of claim 10, wherein the hydrophobic interlayer dielectric
2 layer has a low K value where K is a dielectric constant lower than 3.5.

1 21. A system comprising:
2 a semiconductor package comprising a die, the die having
3 a hydrophobic interlayer dielectric layer that is substantially free of
4 adhered cobalt, and a plurality of cobalt capped copper structures
5 disposed on the interlayer dielectric layer;
6 a bus coupled to the semiconductor package; and
7 a network interface module coupled to the bus.

1 22. The system of claim 21, wherein the semiconductor package comprises a
2 semiconductor device selected from a semiconductor device group consisting of
3 a microprocessor, a memory device, a graphics processor, a digital signal
4 processor, and a crypto processor.

- 1 23. The system of claim 22, wherein the system is a selected one of a a digital
- 2 versatile disk player, an audio/video media player, and a set-top box.